

A Clinical Information Systems Strategy For a Large Integrated Delivery Network

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Integrated delivery networks (IDNs) are an emerging class of health care institutions. IDNs are formed from the affiliation of individual health care institutions and are intended to be more efficient in the current fiscal health care environment. To realize efficiencies and support their strategic visions, IDNs rely critically on excellent information technology (IT). Because of its importance to the mission of the IDN, strategic decisions about IT are made by the top leadership of the IDN.

At Partners HealthCare System, a large IDN in Boston, MA, a clinical information systems strategy has been created to support the Partners clinical vision. In this paper, we discuss the Partners' structure, clinical vision, and current IT initiatives in place to address the clinical vision. The initiatives are: a clinical data repository, inpatient process support, electronic medical records, a portal strategy, referral applications, knowledge resources, support for product lines, patient computing, confidentiality, and clinical decision support. We address several of the issues encountered in trying to bring excellent information technology to a large IDN.

INTRODUCTION

Health care organizations have had to face many challenges over the last several decades with respect to clinical information systems. Some of the biggest problems have been: difficulties in integrating data from disparate ancillary (feeder) applications into common databases; developing easy to use results review applications, developing inpatient and outpatient documentation systems for physicians and nurses, and providing easy access to clinical reference information at the bedside. Only a few organizations have solved these basic problems and have moved on to more advanced clinical systems issues such as the implementation of physician order entry^{1 2 3}, reminders and other clinical decision support^{4 5}, and more recently making their systems available via the web⁶.

Over the past decade, a new kind of health care organization has emerged – the integrated delivery network (IDN). IDNs are created when

independent health care institutions affiliate (in any number of business arrangements) to further their business plans and strategies. Component institutions of IDNs may be academic medical centers, community hospitals, specialty hospitals (e.g., cancer, psychiatric), non-acute facilities (e.g., skilled nursing facilities, rehabilitation hospitals, home health agencies, hospice, etc.), and community physicians. An IDN may also have an insurance plan.

IDNs have emerged nationwide but are very heterogeneous with respect to the nature of the affiliations between the component institutions. The affiliations may include acquisitions, mergers, or cooperation agreements of varying levels of formality. Models for IDNs are still in flux and an IDN may change the nature of the affiliations over time. Although there have been some notable examples of attempts at integration that failed, (e.g., Stanford and UCSF Medical Centers), IDNs are likely here to stay.

The creation of IDNs has occurred in response to fiscal pressures in health care. Revenues, and thus operating margins, have decreased as a result of increased managed care and administrative complexity and the Balanced Budget Act of 1996. Individual health care institutions have affiliated in an attempt to increase overall efficiency and to increase their leverage in negotiations with large payers and suppliers of medical equipment.

One example of the current inefficiency is a situation in which an academic medical center cannot admit a complex (i.e., high reimbursement) patient because their beds are full with less ill (i.e., low reimbursement) patients that could be well cared for at a local community hospital. The community hospital might be well below census but could not admit the complex patient. An arrangement whereby the two hospitals were cooperating to optimally distribute patients would benefit both.

One of the key principles in the creation of an IDN is that information technology (IT) can be created to support the organization and allow the efficiencies to be realized. For example, purchasing, contracting, and claims management must be coordinated among several institutions.

Also, if patients are to move freely between institutions, their clinical data must be readily available at multiple locations. For IDNs to effectively manage care, it is essentially that they have good information. This is true both for fiscal management and clinical management.

The strategic importance of IT to the goals of the IDN is such that it requires that the IT strategy be developed at the highest level of leadership in the IDN. Also, the IT strategy often requires the development of IDN-wide standards for platform, a development environment, and data. The creation, management, and enforcement of these standards often requires central control.

As an example of one environment in which these issues are being addressed, we present the clinical systems strategy for Partners HealthCare System, a large integrated delivery network in Eastern Massachusetts.

PARTNERS STRUCTURE

The component institutions of Partners are shown in Table 1.

Table 1. Component institutions of Partners HealthCare System and the extant clinical information systems platforms.

Type of institution	Institution	Clinical systems platform
Academic medical centers	Brigham & Women's	Internal (BICS) ⁷
	Massachusetts General	Tandem, internal
Community hospitals	Newton Wellesley Hospital	Meditech
	North Shore MC	SMS
	Faulkner Hospital	Meditech
Specialty hospitals	Spaulding Rehab	SMS
	McLean Psychiatric	Internal
Joint venture	Dana Farber Cancer Care	Internal, IDX
Physician network	Partners Community Healthcare Inc.	See text

The component institutions of Partners have a combined operating budget of approximately \$3 billion. Partners was formed in 1994 from the merger of Brigham and Women's Hospital and Massachusetts General Hospital, each large

academic medical centers with operating budgets of close to \$1 billion. Since then, 3 community hospitals, 2 specialty hospitals, a rehab hospital, and a psychiatric hospital have joined Partners. A joint venture to deliver cancer care has been formed with the Dana Farber Cancer Institute.

A large physician network known as Partners Community Healthcare Inc. (PCHI) also has been formed, the goal of which is to negotiate with insurers and managed care organizations, and to direct patients to the most appropriate care settings within the Partners network. PCHI now includes over 1000 primary care physicians (PCPs) organized into 18 regional service organizations (RSOs). The RSOs are responsible for medical management and fiscal management in capitated in contracts. The 18 RSOs have any of a number of contractual arrangements with Partners. Some RSOs are comprised of practices owned by Partners but most simply are affiliated for the purpose of contracting. Some RSOs are independent practice associations (IPAs) and some are physician-hospital organizations (PHOs). The 1000 PCHI PCPs have dealings on a regular basis with about 5000 subspecialist physicians in Eastern Massachusetts.

PARTNERS CLINICAL VISION

A clinical information systems vision should support the clinical goals of the institution. Partners clinical goals are shown in Table 2.

Table 2. Partners' clinical goals.

1) Increased integration
2) Improved quality and improved ability to measure quality
3) Increased efficiency
4) Improved patient satisfaction
5) Improved physician satisfaction and retention within the network
6) Support for academic mission of the institutions
7) Support for service lines

Increased integration means being able to deliver the most appropriate care at the most appropriate setting within the network. In some cases this means actively changing long held patterns of patient movement. In other cases it means better supporting existing patterns (i.e., improving inter-provider communications for existing referral patterns). Physician movement within the IDN also may increase as highly specialized physicians are called upon to deliver care in

multiple locations. An important consequence of the increased movement of patients and physicians is that physicians need to develop a sense of mutual trust and community as they enter new working relationships. One challenge faced by Partners is helping physicians develop a sense of being a "Partners" clinician, whereas previously they may have identified only with one institution.

As shown in Table 2, other goals for Partners are to document the quality of care across the entire IDN and to assure that the care is of the highest quality, to have patients that are satisfied, and to have physicians who are satisfied with working in the network and remain affiliated. Partners is committed to support clinical researchers with the clinical information systems they need to carry out their research.

Another important clinical goal for Partners is the development of coordinated inter-institutional "service lines" for such high profile sectors of care as cardiology, orthopedics, non-acute services, mental health, and oncology.

PARTNERS CLINICAL INFORMATION SYSTEMS INITIATIVES

Partners major clinical information systems initiatives are shown in Table 3.

Table 3. Partners clinical IS initiatives.

1) Clinical data repository
2) Inpatient process support
3) Electronic medical records
4) Portal strategy
5) Referral applications
6) Knowledge resources
7) Product lines
8) Patient computing
9) Confidentiality
10) Clinical decision support

Each initiative will be described briefly.

Clinical data repository (CDR) and results viewer. A CDR that can be used by clinicians to review clinical data in the care of patients is a sine qua non for an IDN. Partners is progressively integrating data from each institution. A results viewer is in use based on work done initially for the MGH.

Inpatient process support. Examples include standard inpatient and chemotherapy-oriented order entry (OE), a medication administration record (MAR), a patient assessment application (for use by nurses), an inpatient inter-physician communication tool (Sign-out⁸), and template-

based inpatient physician documentation tool for admission and discharge notes. These projects are at various stages of development. The OE⁹ and Signout applications are based on earlier versions developed at BWH.

Electronic medical records. The Partners outpatient EMR, known as the Longitudinal Medical Record (LMR) currently is deployed in 4 MGH practices and is in use by 110 physicians. Partners goal is to deploy the LMR to all PCPs and to subspecialists who see a high volume of PCHI patients. Partners faces a number of challenges en route to this goal. As described earlier, the Partners outpatient environment is large, complex, and heterogeneous. Among the clinical community, there is broad general curiosity about EMRs and high (often unrealistic) expectations about the their capabilities. Costs are high, benefit data is soft, and deployment is difficult. Occasionally, departments that are eager to get EMRs right away may be inclined to purchase stand-alone vendor-based EMRs. When the drawbacks of lack of integration are pointed out, the department often reconsiders, however this argument needs to be made on an ongoing basis.

The current efforts with respect to the LMR are to set goals for a feature set, set goals for implementation timelines, consider implementation of key modules (e.g., prescription writing only) for certain care settings to reduce implementation costs, and to continue evaluation activities to document benefits as best as possible.

Portal strategy. This is an effort to host as many web-enabled clinical functions as possible in a browser with a coherent presentation. Such an effort extends the reach of the applications and eases the software distribution burden. Our first example is a portal for the community based physicians which will provide access to the core utilities (e-mail, paging, directories), managed care information, medical resources, and results review.

Referral application strategy. Referrals between providers in a network are a high volume, high cost activity that is a constant source of frustration and inefficiency for providers and patients because information transfers do not happen well¹⁰. Information technology should be able to help, but several logistical issues make this problem non-trivial to solve. Because of the heterogeneity of systems, a Partners-wide solution is not likely for some time. We have done pilot projects in this arena¹⁰ and will continue to look for solutions.

Knowledge resources. Clinicians appreciate the availability of high quality reference information at the bedside. A web-based application at Partners known as Handbook provides access to internally developed articles, CD-ROM based content (e.g., Micromedex, Scientific American Medicine), access to the medical literature through Ovid, and other Internet-based clinical information resources. Issues here include what content to build vs. buy, maintenance, and how to present a coherent, easy-to-navigate interface.

Support for product lines. Supporting a sector of care (e.g., non-acute, cardiology) across the IDN requires extensive planning, workflow analysis, and coordination. At Partners, the non-acute service line group is furthest along in thinking about how this might work. At a minimum, a database of non-acute providers will be created so such providers easily can be identified and contacted. Eventually, a standardized clinical data set will be updated as the patient moves from the acute setting into skilled nursing, rehabilitation, and home care settings. Such a vision requires the commitment of several institutions and providers to enter data. Data review can be done via a browser.

Patient computing. Partners is committed to providing Internet-based applications for patients to use to communicate with their providers and to receive health and institutional information. This development is in a prototype stage.

Confidentiality. Although enterprise-wide confidentiality policies have been created, their implementation across all the sites is proceeding at an uneven rate. Many of the IDN-wide applications can be implemented as intended only when a uniform approach to confidentiality is in place (e.g., when may one clinician see another's EMR notes, what are the policies for granting data review privileges, what should be the policies around communicating electronically with patients). These activities require much communication and coordination but need to be addressed if appropriate action is to be taken and the HIPAA regulations are to be addressed.

Clinical decision support (CDS) and consistent data representation. These are not initiatives per se, but rather principles that pervade the clinical applications. Partners institutions previously have documented a huge ROI based on the presence of alerts and reminders in the clinical applications^{9 12}. These activities were focused on the inpatient setting and new opportunities exist in the outpatient setting.

Also, to achieve the benefits of integrated clinical systems, data must be recorded

consistently in multiple applications. For example, if medication orders need to be used by the MAR, the two applications must have an understanding of how this will be achieved. This extends to the use of laboratory results, problem lists, etc. Clinical applications development needs to be managed appropriately to assure consistency is achieved.

DISCUSSION

Excellent clinical information systems are critical to IDNs. In future, IDNs with strong clinical information systems may enjoy a competitive advantage because the systems will allow the IDN to deliver demonstrably more efficient and higher quality care¹¹.

The major clinical systems initiatives at Partners all are targeted at the Partners clinical vision and each can have a significant impact on clinical care. The activities have broad impact. As a group, they affect all Partners institutions, the inpatient and outpatient setting, all classes of providers, and patients. Several of the current initiatives extend and enhance systems that have been in place at one or another of the Partners institutions (e.g., results review, order entry, outpatient EMRs) and have been shown to be of benefit. Partners has a long tradition of evaluating the impact of clinical systems on the cost and quality of care¹² and is committed to continuing these activities. Also, Partners recognizes the value of browser-based environments and is doing all new development for a light client architecture and is trying to "web-enable" the existing clinical systems. Partners does a large amount of internal development, but vendor-based systems that are in place and working well will not be removed.

Also, the clinical information systems place several critical requirements on the technology platform in general. For example, the network and client computers need to be distributed widely and must be fast, reliable, secure, and integrable. Core databases to support an IDN, such as an enterprise master patient index (EMPI) and a master provider database need to be in place. Core utilities such as e-mail, a paging system, provider and phone directories need to be in place. Also, several non-clinical applications such as registration, scheduling, and claims management interact with clinical systems and often need to be integrated to provide maximum clinical convenience and support for quality management activities.

The creation of the strategy is a complex process, in large part because Partners is a

complex organization. Senior leadership from Partners management, the member institutions, and Information Systems contribute to discussions that determine the general direction for clinical information systems. Executive committees at the member institutions consisting of the CEO, CMO, and other senior leaders are responsible for local decisions. Which decisions the member institutions should make, and which should be made centrally at Partners, is the subject of several interesting discussions, but this is necessarily the case in all IDNs.

Each member institution has a Clinical Advisory Group (CAG) to serve as a conduit between the clinicians and IS about clinical systems issues. The CAGs, composed of senior clinical leadership, meet monthly with IS to give input about relevant issues and to hear updates about ongoing projects.

In the Information Systems Department, four main groups contribute to the direction of the clinical systems. These are Applications Development (programming), Clinical Systems Management (rollout, support, training, and user liaison), Clinical Information System Research and Development (responsible for bringing the Informatics perspective to the projects), and Clinical Quality Analysis (responsible for measuring the impact of the systems). A Clinical Systems Strategy meeting is held monthly that includes the directors of these 4 groups, the Partners CIO, the CIOs from each of the member institutions, and directors from such other key divisions of IS as Technology Planning, Telemedicine, and Enterprise Services. These meetings coordinate clinical systems activities within IS.

CONCLUSION

Integrated delivery networks are an emerging class of health care institutions with unique, high profile, clinical information technology needs. We have described the clinical information systems strategy for one large IDN.

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